Notation $y = f(x)$

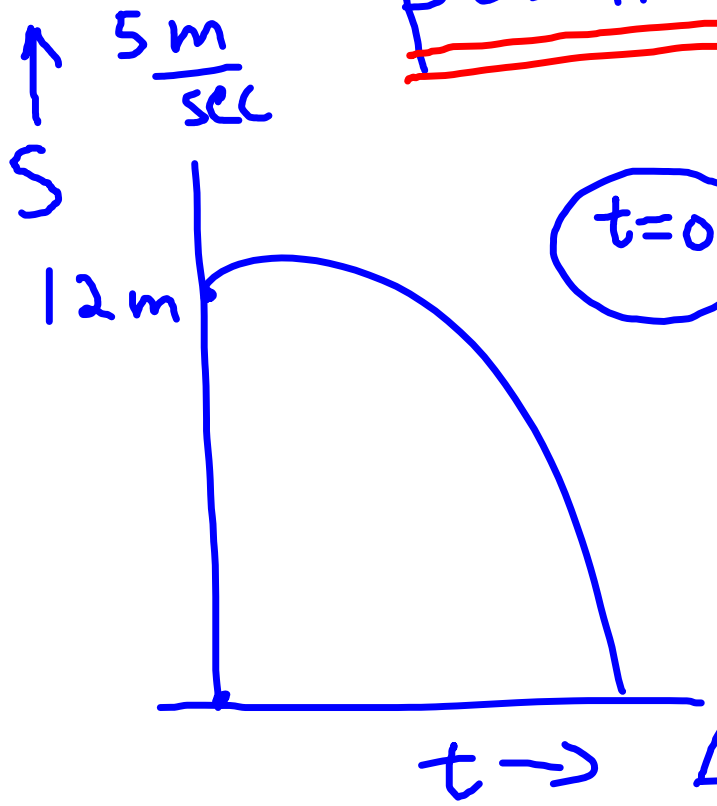
Tangent Slope Function or Derivative

$tsf(x)$, $f'(x)$, $D[f(x)]$, $\frac{dy}{dx}$

- position: $s(t)$
- velocity: $v(t) = s'(t)$
- acceleration: $a(t) = v'(t) = s''(t)$

Application to motion in 1 dim with constant acceleration.

Position: $s(t) = a_0\frac{t^2}{2} + v_0 t + s_0$



s_0 = initial position

v_0 = " velocity

a_0 = " acceleration

velocity:

$$v(t) = s'(t) = a_0 t + v_0$$

$$s(t) = -\frac{9.8}{2} t^2 + 5t + 12$$

$$v(t) = s'(t) = -\frac{9.8 \cdot 2}{2} t + 5 + 0$$

a. $s(t) = -9.8\frac{t^2}{2} + 5t + 12$ position

$v(t) = s'(t) = -9.8t + 5$ velocity

$a(t) = s''(t) = -9.8$ ✓ acceleration

SHW 5
Problem 1

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b. $v(t) = 0$

$s'(t) = -9.8t + 5 = 0$

$t = .510$ s

$s(.510) = -\frac{9.8}{2}(.51)^2 + 5(.51) + 12$

$= 13.28$ m

c. $s(t) = 3$

$$-\frac{9.8}{2}t^2 + 5t + 12 = 3$$

$$-\frac{9.8}{2}t^2 + 5t + 9 = 0$$

$$t = 1.958 \text{ sec}$$

$$v(1.958) = s'(1.958)$$

$$= -9.8(1.958) + 5$$

$$= -14.188 \frac{m}{sec}$$

d. $s(t) = 0$

$$-\frac{9.8}{2}t^2 + 5t + 12 = 0$$

$$\boxed{t = 2.1568 \text{ sec}}$$

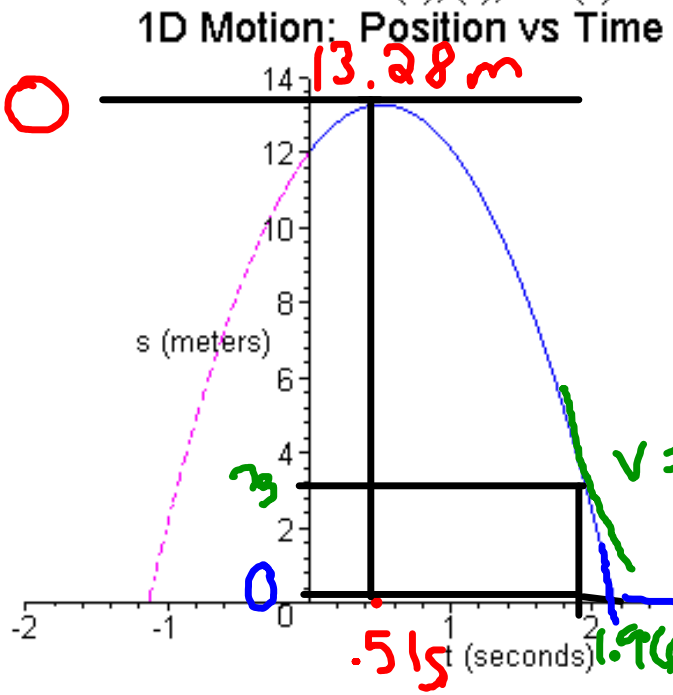
$$v(2.1568) = s'(2.1568)$$

$$= -9.8(2.1568) + 5$$

$$= \boxed{-16.1288 \frac{m}{sec}}$$

e.

Label the following Position vs Time graph with all the information found in (b), (c), and (d).



Scott

"Maddie"

Emily

V=0

13.28 m

3

0

.515

1.96

$v = -14.19 \frac{m}{s}$

2.1568 s

V = -16.1288 m/s

2. $s(t) = a_0\frac{t^2}{2} + v_0 t + s_0$

a. $s_0 = 0$ m

$v_0 = 0$ m/s

$a_0 = 11$ m/s²

$s(t) = \frac{1}{2}(11)t^2 + (0)t + 0$

$s(t) = 5.5t^2$

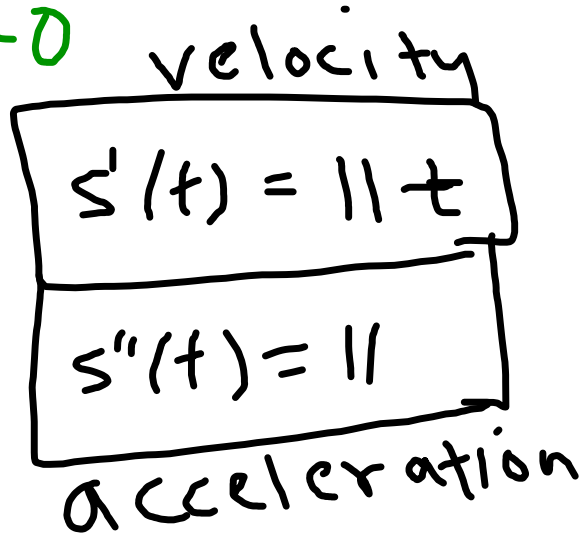
$s'(t) = a_0 t + v_0$

$= 11t + 0$

Samah

$s'(t) = 11t$

$s''(t) = 11$ m/s²



b. $S(t)=370$

Scott

$\frac{5.5t^2}{5.5} = \frac{370}{5.5}$

$\sqrt{t^2} = \sqrt{67.2}$

$t = 8.20\ s$

$S'(t) = 11t$

$(11)(8.2) = 90.22\ \frac{m}{s}$

c. $s(t) = 5.5t^2$

$185 = 5.5t^2$

$\sqrt{t^2} = \sqrt{33.63...}$

$t = 5.79...\ s$

$s'(t) = 11t$

$= 11(5.79...)$

velocity $= 63.79 \frac{m}{s}$

M-dawg

9.

$$\frac{75}{11} = 6.8$$

$11(t) = 75\ m/s$

$t = 6.8$ Seconds

$5.5t^2 = s$

$5.5(6.8)^2 =$

254.32 m

Burke

SHW 5 Problem 3. 1D Motion with Constant Acceleration

A hot air balloon is ascending at a constant speed of 11 m/s. When it is 10 m above the ground, a care package is released from the balloon.

(a) Specify the position and velocity functions for the motion of the package.

$s(t) = \frac{1}{2}a_0 t^2 + v_0 t + s_0$

$s(t) = \frac{-9.8}{2}t^2 + 11t + 10$

$s(t) = -4.9t^2 + 11t + 10$

(V) $s' = -9.8t + 11$

(A) $s'' = -9.8$ Scott

(b) What is the maximum height reached by the package?

$v(t) = 0$

$s'(t) = -9.8t + 11 = 0$

$t = 1.122$ s

$s(1.122) = -4.9(1.122)^2 + 11(1.122) + 10$

$s(t) = 16.174$ m Britt

(c) How long after being released does it take the package to reach a height of 14 m, and what is the velocity of the package when it reaches this height?

Burke $14 = -4.9(t)^2 + 11t + 10$

$0 = -4.9(t)^2 + 11t - 4$

$\frac{-11 \pm \sqrt{121 - 4(-4.9)}}{-9.8}$

.456 s or 1.79 s

$-9.8(2.94) + 11$

$v = -9.8(.456) + 11$

$v = 6.53$ m/s

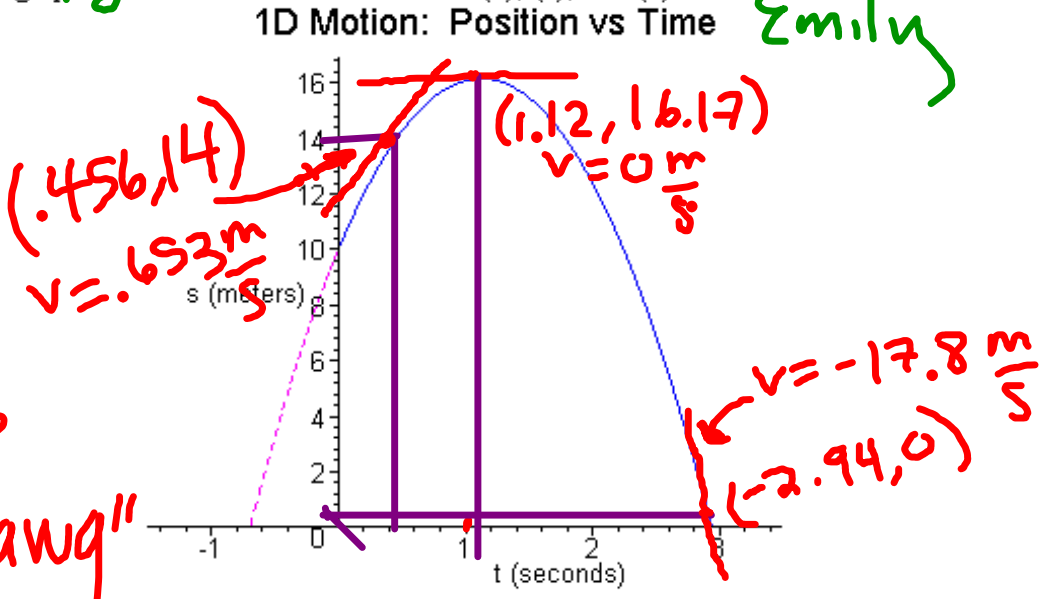
(d) How long after being released does it take the package to hit the ground, and what is the velocity of the package just before it hits the ground?

$0 = \frac{1}{2}(-9.8)t^2 + 11t + 10$ $t = 2.939$ s $v = -17.8$ m/s

$t = \frac{-11 \pm \sqrt{11^2 - (4)(-4.9)(10)}}{-9.8}$ $v(t) = -9.8(2.939) + 11$

(e) Label the following Position vs Time graph with all the information found in (b), (c), and (d).

Emily



Maddie "Maddawg"

SHW 5 Problem 4. 1D Motion with Constant Acceleration

A hot air balloon is descending at a constant speed of 5 m/s. When it is 22 m above the ground, a care package is released from the balloon.

(a) Specify the position and velocity functions for the motion of the package.

$$s(t) = \frac{1}{2}a_0 t^2 + v_0 t + s_0$$

$s'(t) = -9.8t - 5$

$s(t) = \frac{1}{2}(-9.8)t^2 - 5t + 22$ $\quad s'(t) = -9.8$

(b) What is the maximum height of the package after it is released? Explain your answer.

b/c the baloon is decending, the pkg's highest point is when it is dropped at 22m. Scott

(c) How long after being released does it take the package to reach a height of 10 m, and what is the velocity of the package when it reaches this height?

$10 = -4.9(t)^2 + -5t + 22$ a. $t = 1.136$ s

$0 = -4.9(t)^2 + -5t + 12$ b. $v = -9.8(1.136) - 5$ Burke

quad → $v = -16.122$ m/s

(d) How long after being released does it take the package to hit the ground, and what is the velocity of the package just before it hits the ground?

(d) How long after being released does it take the package to hit the ground, and what is the velocity of the package just before it hits the ground?

$s(t)=0$

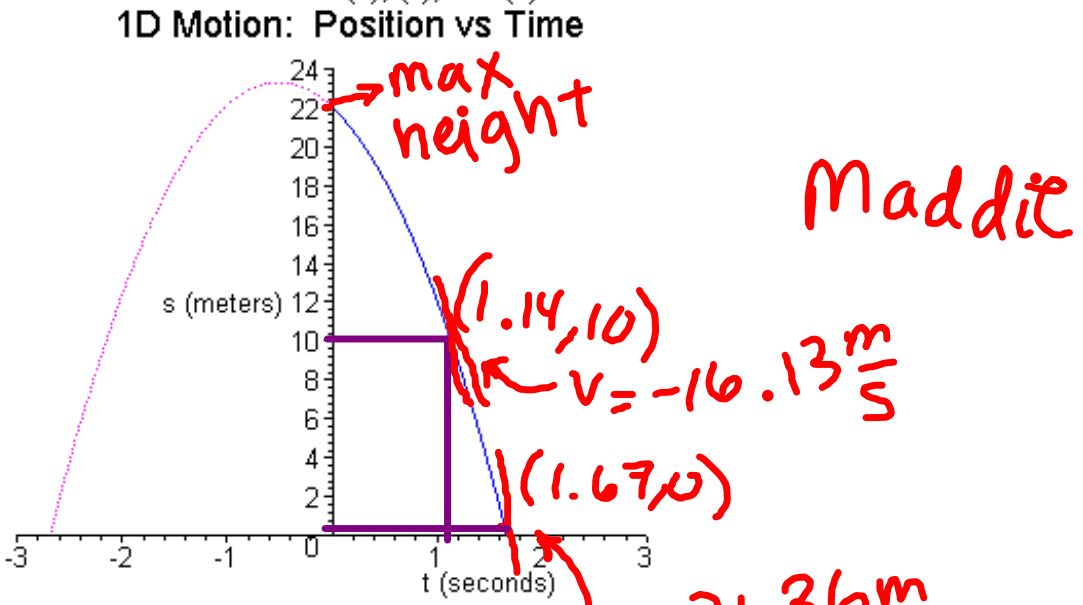
$-4.9t^2-5t+22=0$

$t=1.669s$

$s'(t)=-9.8(1.669)-5$

$s'(t)=-21.356\ m/s$ Britt

(e) Label the following Position vs Time graph with all the information found in (b), (c), and (d).



SHW 5 Problem 5. 1D Motion with Constant Acceleration

A hot air balloon is hovering motionlessly 35 m above the ground, when a care package is released from the balloon.

(a) Specify the position and velocity functions for the motion of the package.

$$s(t) = \frac{1}{2}a_0 t^2 + v_0 t + s_0$$

$s(t) = \frac{1}{2}(-9.8)t^2 + 0 + 35$

$s'(t) = -9.8t$

$s''(t) = -9.8$

(b) What is the maximum height of the package after it is released? Explain your answer.

35m

~~balloon~~ package is dropped

(c) How long after being released does it take the package to reach a height of 25 m, and what is the velocity of the package when it reaches this height?

$s(t) = -4.9t^2 + 35$

$25 = -4.9t^2 + 35$

$\frac{-10}{-4.9} = \frac{-4.9t^2}{-4.9}$

$\sqrt{2.04} = \sqrt{t^2}$

$t = 1.43\,s$

$s'(t) = -4.8t$

$= -9.8(1.43)$

$= -14\ m/s$

(d) What is the maximum speed attained by the package?

$s(t) = 0$

$-4.9t^2 + 35 = 0$

$t = \sqrt{\frac{35}{4.9}} = 2.6725\ s$

$s'(2.67) = -9.8(2.67)$

$= -26.19\ \frac{m}{s}$

speed $= |-26.19|$

$= 26.19\ \frac{m}{s}$

(e) Label the following Position vs Time graph with all the information found in (b), (c), and (d).